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WO 92/00120 A1 US 4799477 A

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(54) A face mask incorporating breathing equipment for aircrew

(57) A face mask for aircrew, to feed breathing gas to the wearer. An inflatable bladder 34 is located between a rigid shell 26 and a face piece 28 so that inflation of the bladder 34 forces the face piece 28 against the wearer's face. The bladder is inflatable through a passage 46 in the shell which connects to a breathing gas inlet to the mask.

In another embodiment the bladder 34 is located between the outer shell 26 and an inner shell 30 that receives the facepiece 28 therein.

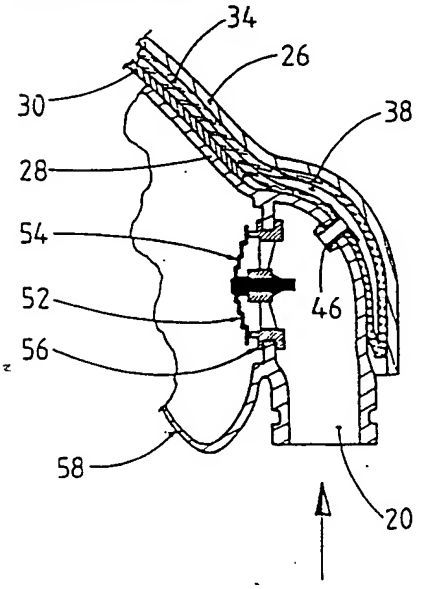

FIGURE:6

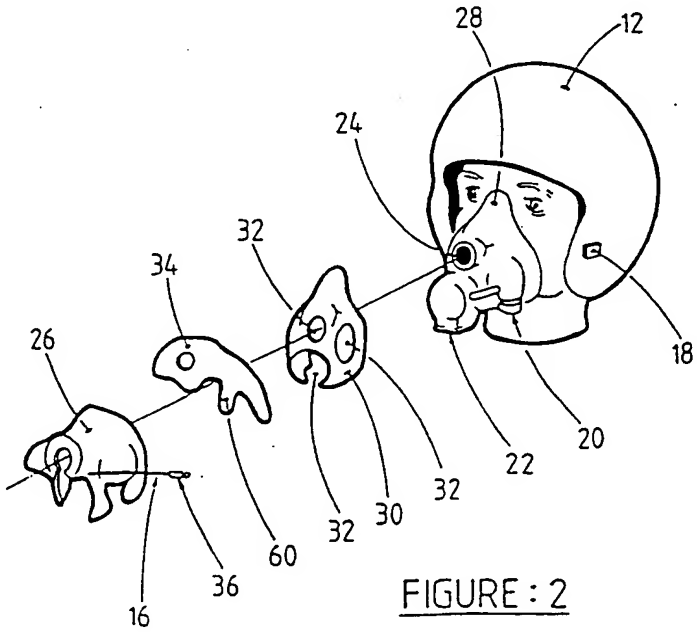

FIGURE : 2

At least one drawing originally filed was informal and the print reproduced here is taken from a later filed formal copy.

The claims were filed later than the filing date within the period prescribed by Rule 25(1) of the Patents Rules 1990.

This print incorporates corrections made under Section 117(1) of the Patents Act 1977.

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A Face Mask Incorporating Breathing Equipment for Aircrew

This invention relates to a face mask of the type worn by aircrew, particularly in military aircraft, to feed breathing gas to the wearer.

It is conventional for pilots and other aircrew members in unpressurised aircraft to wear a face mask through which oxygen or other breathing gas is fed to the wearer to allow breathing of the correct breathing mixture, whatever the altitude/speed of the aircraft. Known face masks have a soft rubber face piece which makes a seal with the wearers face, around the nose and mouth, and a rigid outer shell which is secured to the wearers helmet, and thus is braced against the back of the wearers head. By adjusting the straps or other mechanism which hold the outer shell to the helmet, the force with which the face piece is pressed against the face can be adjusted.

With such masks, it is conventional to have two settings for the position of the face piece relative to the face. The first setting is a normal setting which is adequate to provide the necessary seal during normal flight. However when the aircraft is required to undertake extreme manoeuvres leading to high G-forces on the pilot (and on any other aircrew) then it becomes necessary to supply the pilot with oxygen at elevated pressure, so that the pilot undertakes so-called pressure breathing. Under these conditions the breathing gas pressure inside the face piece is considerably higher than normal, and it becomes especially important to ensure that there is a good seal between the face piece and the wearers face.

In the conventional arrangement, a toggle in the strap arrangement connecting the face mask to the helmet can be

operated under such conditions to increase the tension in the strap arrangement and thus to increase the force with which the face piece is pressed against the face.

It is also known to use an inflatable bladder in association with the helmet and mask to provide this increased force when pressure breathing is required. The bladder can be placed behind the wearers head as shown for example in British Patent Specification 826198, or around the periphery of the face piece as shown for example in French Patent Specification 2657264.

According to the present invention there is provided a face mask incorporating breathing equipment for aircrew, the mask comprising a flexible face piece, a rigid shell, means for bracing the shell against the back of the head of a wearer, and an inflatable bladder located between the shell and the face piece so that the inflation of the bladder forces the face piece against the wearers face, wherein the bladder is inflated through a passage which is located inside the shell and which connects the interior of the bladder to a breathing gas inlet to the mask.

By locating the bladder inflation passage inside the shell, the bladder can be inflated by the breathing gas pressure without requiring a separate connection to the mask for this purpose.

The bladder is preferably provided with a nipple having a through passage communicating with the bladder interior and the flexible face piece preferably has a hole through the wall thereof for receiving this nipple. The nipple may be moulded into the bladder during manufacture or attached with sealing adhesive after manufacture of the bladder.

The nipple may have an enlarged and tapered head, so that this head can be forced through the hole in the flexible wall of the face piece before being retained against and sealing with the edges of the hole, or may be fitted with a sparate retaining means situated within the face piece.

The breathing gas inlet to the mask will normally include a non-return inlet valve, and the bladder inflation passage is preferably located upstream of this valve.

The bladder is preferably a separate component from the face piece and the rigid shell.

The breathing gas inlet to the mask may be located on one side of the face piece and another emergency breathing air passage to the face piece can be located on the opposite side. With this arrangement, the bladder can be located on the face mask on one side by the engagement of the nipple through the wall of the face piece, and on the other side by locating around the emergency breathing air passage which, in a preferred embodiment, contains an anti-suffocation valve. The bladder preferably has a toroidal shape when inflated with a central hole surrounding the emergency breathing air passage.

The bladder preferably also has an irregular periphery which allows the internal cavity of the bladder to extend between other components mounted on the face piece.

According to a second aspect of the invention, there is provided a face mask incorporating breathing equipment for aircrew, the mask comprising a flexible face piece, a rigid outer shell, means for bracing the shell against the back of the head of a wearer, and an inflatable bladder located between the shell and the face piece so that the inflation

of the bladder forces the face piece against the wearers face, wherein an inner rigid shell is located between the bladder and the face piece.

The inner rigid shell is provided to spread the loads imposed on the facepiece by inflation of the bladder evenly over the face piece so that the entire periphery of the facepiece is pressed against the wearer's face when the bladder infaltes. The rigidity of the shell therefore needs to be greater than that of both the bladder and the facepiece, but can be less rigid than the outer shell.

The inner shell can be moulded to follow the external contours of the face piece, and may for example be made of glass fibre reinforced plastics or vacuum formed thermoplastics.

The invention will now be further described, by way of example, with reference to the accompanying drawings, in which:

Figure 1 is a perspective view of a pilot wearing a flying helmet with a face mask in accordance with the invention;

Figure 2 is an exploded view of the face mask shown in Figure 1;

Figure 3 is a detail of the bladder shown in Figure 2;

Figure 4 is a section through the bladder of Figure 3 on the lines IV - IV;

Figure 5 is a section through the bladder of Figure 3 on the lines V - V; and

Figure 6 is a section through the assembled mask on the lines VI - VI from Figure 1.

Figure 1 shows a pilot 10 wearing a flying helmet 12 with a face mask 14. The mask is connected to the helmet 12 by straps 16 which connect to the helmet through clips 18. The face mask has a breathing gas inlet 20, an air outlet 22 (which incorporates an exhalation valve) and a microphone location at 24.

In Figure 1, the rigid outer shell 26 and the flexible face piece 28 of the mask can also be seen. Figure 2 shows that the face mask 14 has four main components. A soft rubber face piece 28 fits against the face and carries the gas inlet 20 and outlet 22. A rigid inner shell 30 fits over the face piece 28 and has apertures 32 to fit around the various projections on the front of the face piece.

An inflatable bladder 34 fits over the inner shell 30, and a rigid outer shell 26 fits over the bladder 34. The shell 26 carries straps 16 which end in connection pins 36 to be inserted into sockets 18 on the helmet 12. the straps 16 may be of wire or webbing and are required to support tension loads, in use.

The bladder construction is shown in more detail in Figures 3, 4 and 5. The bladder has an irregularly shaped profile as shown and an internal cavity 38 which is sealed round the peripheral edge of the bladder at 40. At one point the bladder has a hole 42 through it, and the cavity is sealed at 44 around this hole. This hole is provided for location around an anti-suffocation valve (not shown in the drawings) on the face piece 28.

The bladder is inflated through a nipple 46 which has a

through passage 48 leading into the cavity 38. The nipple has an enlarged and tapered head 50. Figure 6 shows how this tapered head fits through a hole in the wall of the face piece 28 to form a seal there.

Figure 6 shows the location of the bladder 34 between the outer shell 26 and the inner shell 30, with the flexible face piece 28 located in the inner shell 30. The breathing gas is supplied to the interior of the face piece 28 through an inlet channel 20 and through a non-return valve 52. This non-return valve comprises a flexible diaphragm 54 which sits on an annular seat 56 and opens when the wearer of the mask inhales and closes when the wearer exhales. The nipple 46 is located in the inlet 20 on the upstream side of the valve so that the pressure fed to the bladder 34 is always at inlet gas pressure.

It will be seen from Figure 6 that no external tubes or other fittings are required in order to feed the necessary gas pressure into the air pressure 34 and that therefore a particularly neat construction is achieved. Assembly is also straightforward since the air connection is made simply by pushing the nipple 46 through the wall of the face piece, and there is no requirement to seal joints at both ends of a separate piece of tubing. Furthermore the use of the nipple 46, together with the opening 42, ensures correct location of the bladder between the face piece and the outer shell.

The face piece 28 has a sealing edge 58 to seal against the face. This sealing edge 58 extends all the way around the periphery of the face piece to make a seal with the contours of the face, and the material of the face piece is soft enough to mould itself to the contours of each individuals face. In order to ensure correct transfer of pressure to

the face piece, the rigid inner shell 30 is used to spread the load applied by the bladder evenly over the face piece.

The face mask is assembled generally in the order shown in Figure 2. That is the inner shell 30 is placed over the face piece 28; the bladder is laid over the top of the face piece with the hole 42 fitting over an anti-suffocation valve which extends from the side of the face piece not visible in the drawings; the nipple 42 is pressed through the wall of the face piece as shown in Figure 6 and the downwardly extending tongue 60 lies between the air inlet 20 and the microphone socket 24. Finally, the rigid outer shell 26 is put into place to complete the assembly.

CLAIMS

1 A face mask incorporating breathing equipment for aircrew, the mask comprising a flexible face piece, a rigid shell, means for bracing the shell against the back of the head of a wearer, and an inflatable bladder located between the shell and the face piece so that inflation of the bladder forces the face piece against the wearer's face, wherein the bladder is inflated through a passage which is located inside the shell and which connects the interior of the bladder to a breathing gas inlet to the mask.

2 A face mask according to claim 1 wherein the bladder is provided with a nipple having a through passage communicating with the bladder interior and the flexible face piece has a hole through the wall thereof for receiving this nipple.

3 A face mask according to claim 2 wherein the nipple has an enlarged and tapered head so that this head can be forced through the hole in the flexible wall of the face piece before being retained against and sealing with the edges of the hole.

4 A face mask according to claim 2 wherein the nipple is fitted with a separate retaining means situated within the face piece to retain it against and seal it with the edges of the hole.

5 A face mask according to any of the preceding claims wherein the breathing gas inlet includes a non-return inlet valve.

6 A face mask according to claim 5 wherein the bladder inflation passage is located upstream of the non return inlet valve.

7 A face mask according to any of the preceding claims wherein the bladder is a separate component from the face piece and the rigid shell.

8 A face mask according to any of the preceding claims wherein the breathing gas inlet to the mask is located on one side of the face piece and another emergency breathing air passage to the face piece is located on the opposite side.

9 A face mask according to claim 8 wherein the bladder is located on the face mask on one side by the engagement of the nipple through the wall of the face piece, and on the other side by locating around the emergency breathing air passage.

10 A face mask according to claim 8 or claim 9 wherein the emergency breathing air passage contains an anti-suffocation valve.

11 A face mask according to claim 9 or claim 10 wherein the bladder has a toroidal shape when inflated.

12 A face mask according to any of the preceding claims wherein the bladder has an irregular periphery which allows the internal cavity of the bladder to extend between other components mounted on the face piece.

13 A face mask incorporating breathing equipment for aircrew, the mask comprising a flexible face piece, a rigid outer shell, means for bracing the shell against the back of

the head of the wearer, and an inflatable bladder located between the shell and the face piece so that inflation of the bladder forces the face piece against the wearer's face, wherein an inner rigid shell is located between the bladder and the face piece to spread the loads imposed on the face piece by inflation of the bladder evenly over the face piece so that the entire periphery of the face piece is pressed against the wearer's face when the bladder inflates.

14 A face mask according to claim 13 wherein the inner shell is moulded to follow the external contours of the face piece.

15 A face mask according to claim 13 or claim 14 wherein the inner shell is made of glass fibre reinforced plastics material.

16 A face mask according to claim 13 or claim 14 wherein the inner shell is made of vacuum formed thermoplastics material.

17 A face mask substantially as herein described with reference to the accompanying drawings.

18 A bladder for a face mask as claimed in any preceding claim.

19 A bladder for a face mask substantially as herein described with reference to the accompanying drawings.

Patents Act 1977
Examiner's report to the Comptroller under section 17 (The Search Report)

Application number
GB 9212571.5

Relevant Technical fields

(i) UK Cl (Edition L) A5T (TCH, TCL, TCT)

(ii) Int Cl (Edition 5) A61M; A62B

Search Examiner

M SIDDIQUE

Databases (see over)

(i) UK Patent Office

(ii) ONLINE DATABASE: WPI

Date of Search

30 MARCH 1993

Documents considered relevant following a search in respect of claims 1-12

Category (see over)	Identity of document and relevant passages	Relevant to claim(s)
X,Y	WO 92/00120 A1 (CAM LOCK) Figures 1, 2 at least; passage inside shell connects via passage 12 the interior of bladder 15 to inlet 11 in the mask	X: 1,7 Y: 1,7
Y	US 4799477 (LEWIS) column 1 lines 56-59	1,7

Category	Identity of document and relevant passages	Relevant to claim(s)

Categories of documents

X: Document indicating lack of novelty or of inventive step.

Y: Document indicating lack of inventive step if combined with one or more other documents of the same category.

A: Document indicating technological background and/or state of the art.

P: Document published on or after the declared priority date but before the filing date of the present application.

E: Patent document published on or after, but with priority date earlier than, the filing date of the present application.

&: Member of the same patent family, corresponding document.

Databases: The UK Patent Office database comprises classified collections of GB, EP, WO and US patent specifications as outlined periodically in the Official Journal (Patents). The on-line databases

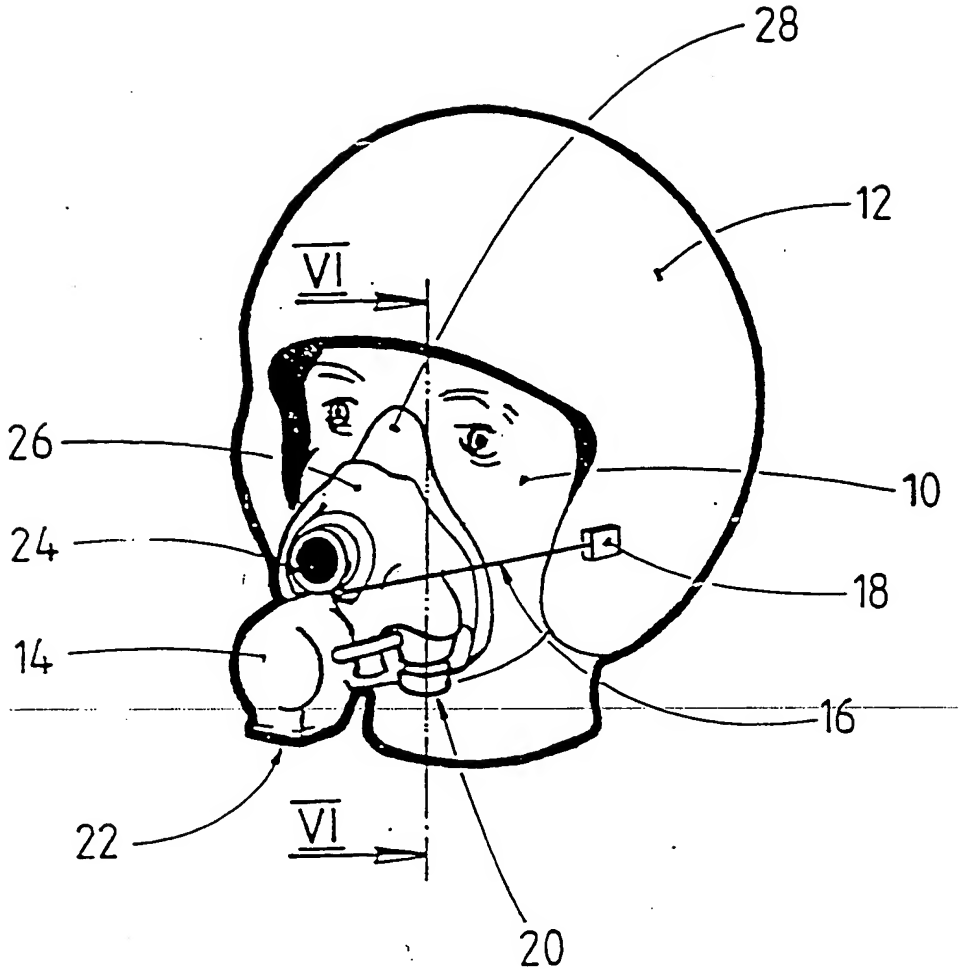


FIGURE : 1

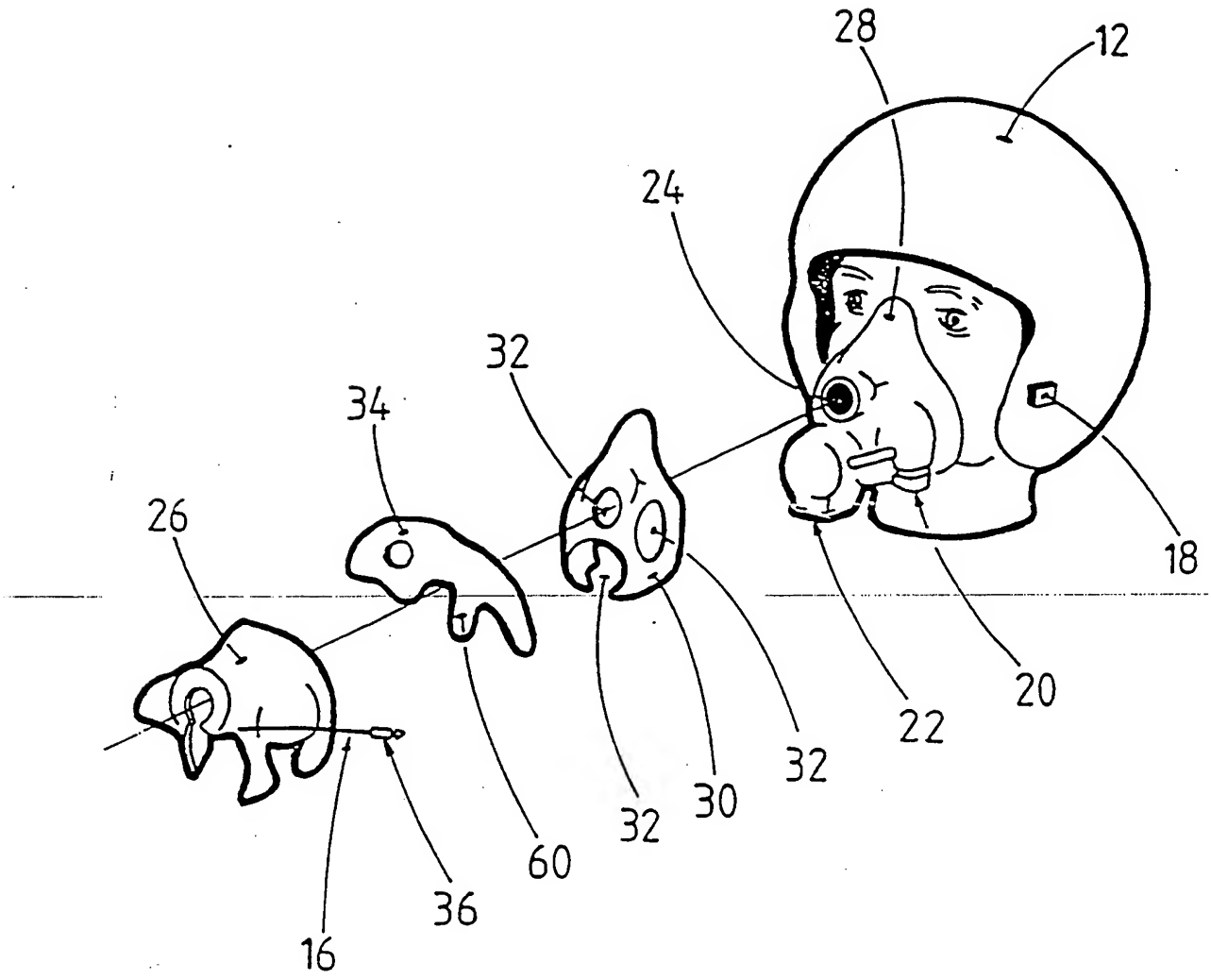
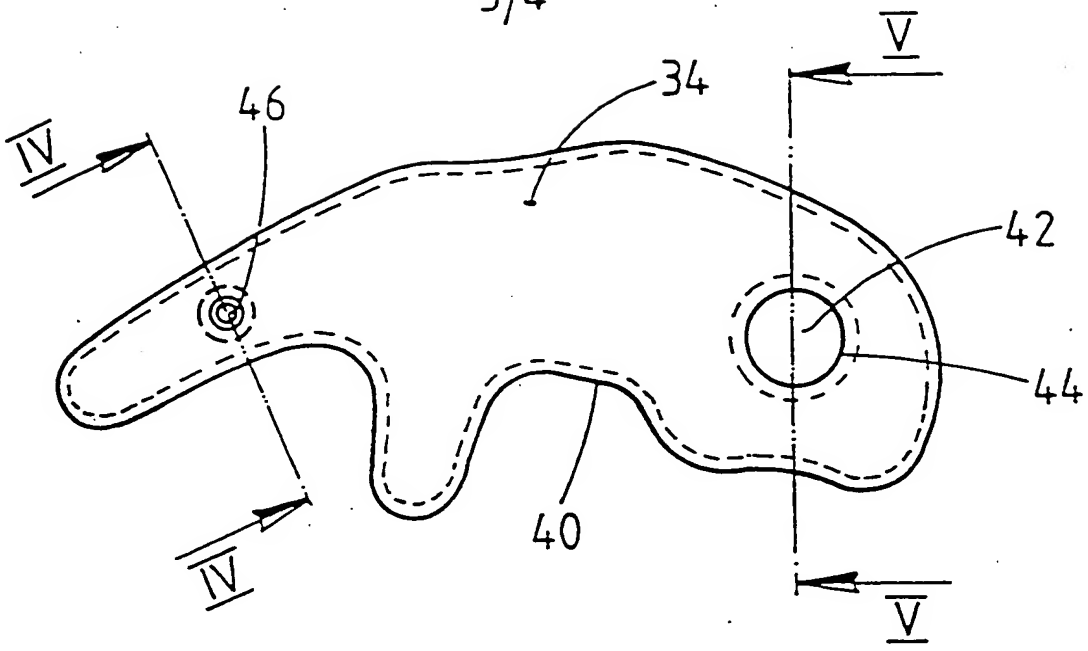


FIGURE : 2



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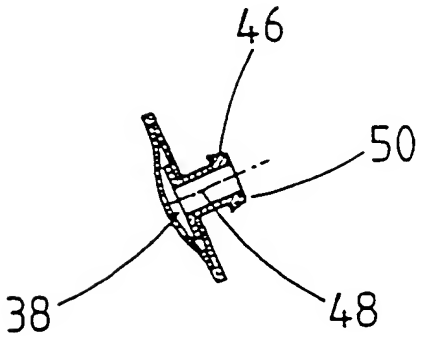

FIGURE : 4

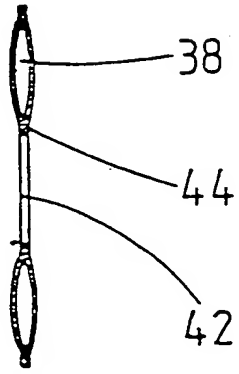

FIGURE : 5

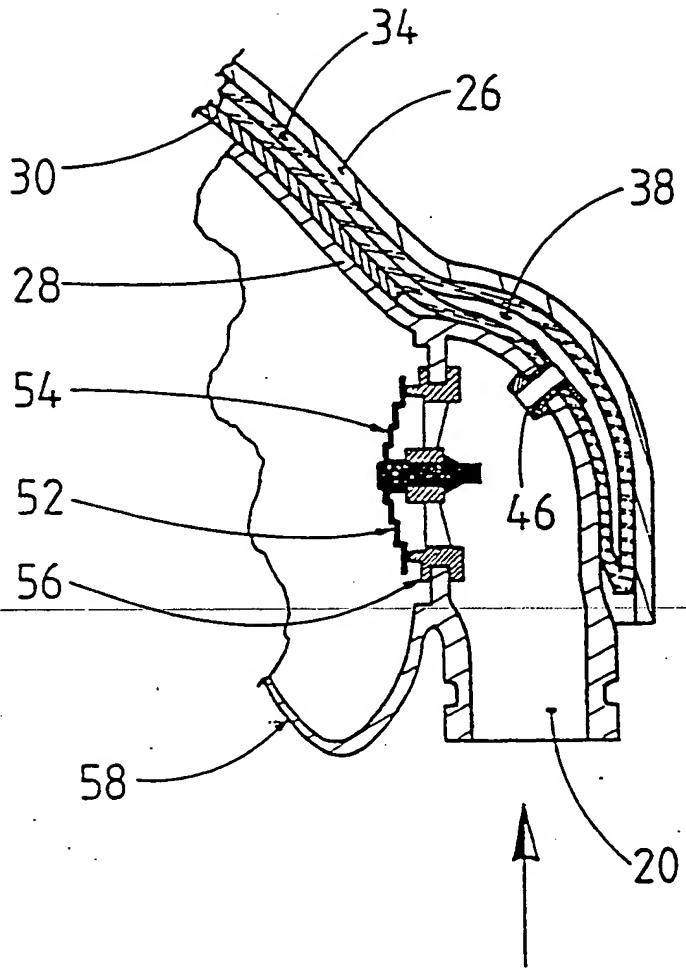

FIGURE:6